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(54) Abstract Title
An air flow control arrangement

(57) An air flow control arrangement for a motor vehicle ventilation system comprises a plurality of vent members (1; 31) which include flaps (4; 34, 35) and which may have an electrostatic charge induced into them from an electrically conductive core (3; 33). Thus, when a similar polarity electrostatic charge is provided between the flap (4; 34, 35) and a core section (5; 32), the flap (4; 34, 35) is repulsed in order to expose a vent pathway (2; 38, 39) whilst electrostatic charges of an opposite polarity between the flap (4; 34, 35) and the core section (5; 32) results in attraction therebetween in order to close the vent pathway (2; 38, 39). Thus, air flow control through the pathways (2; 38, 39) is achieved without manual manipulation or use of potentially unreliable mechanical actuation.

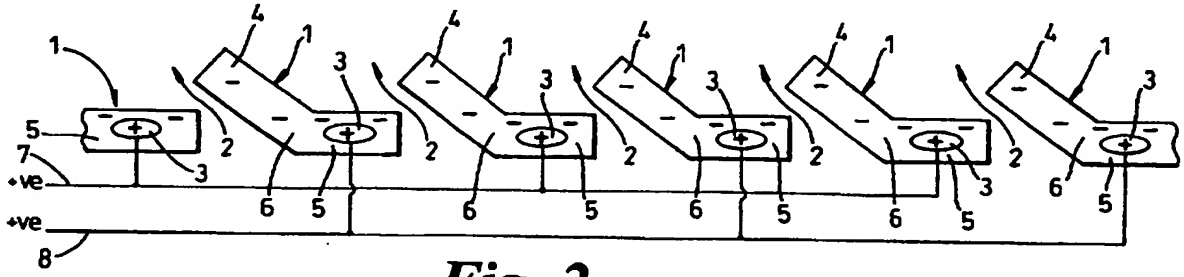

Fig. 2

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

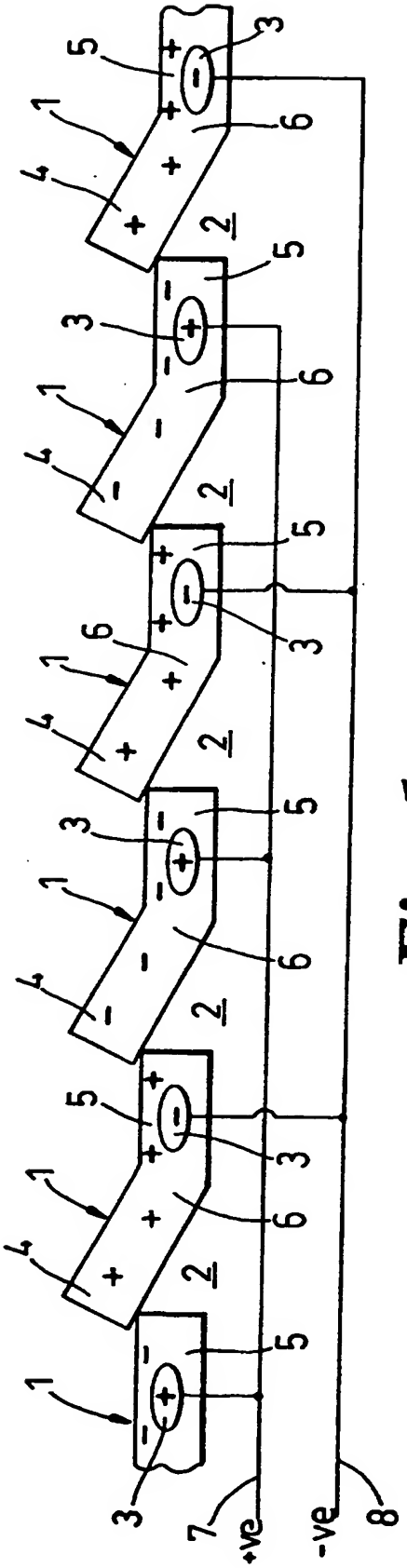

Fig. 1

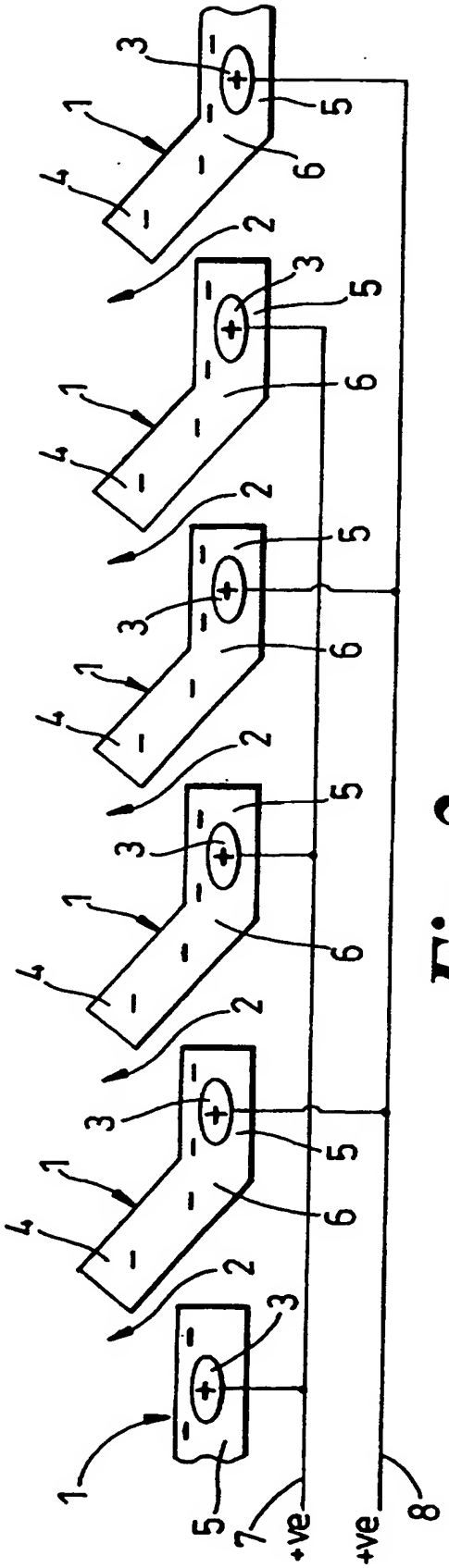

Fig. 2

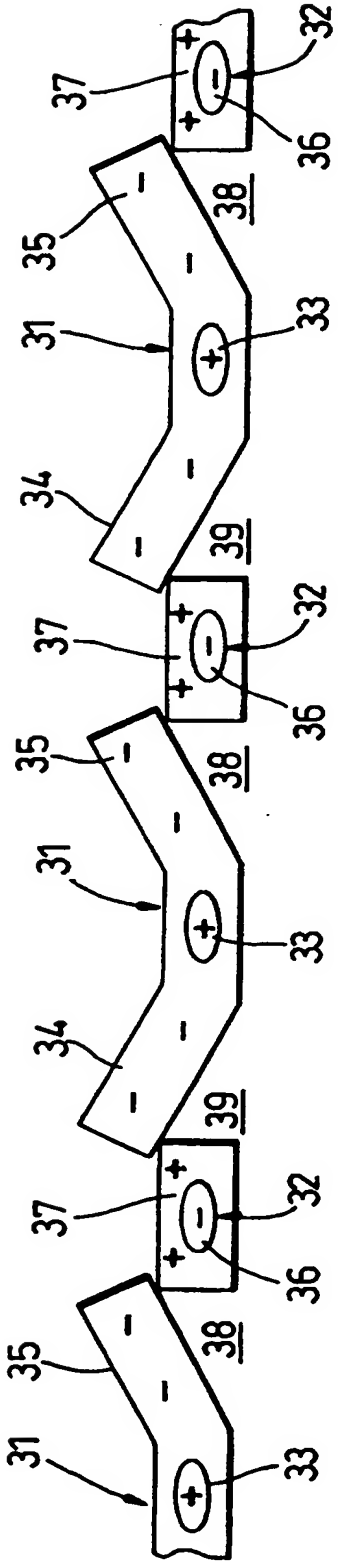

Fig. 3

AN AIR FLOW CONTROL ARRANGEMENT

The present invention relates to an air flow control arrangement and more particularly to an air flow control arrangement used within a motor vehicle ventilation system.

In order to facilitate vehicle occupant comfort, it is common to include a ventilation system within a vehicle. Clearly, in order to induce ventilation air flow, it is necessary to distribute air flows through various vents towards the cabin of that vehicle. Thus, a vehicle ventilation system will include distribution valves in order to regulate as well as direct desired air flows towards those vents selected, either by the vehicle occupant or an automatic climate control system..

Typically, previously the means used to distribute and regulate air flows within a vehicle ventilation system have included baffle valves and louver screens in which movement of a baffle or the louver panels has been achieved through a manual displacement or by using a servo motor or similar device. Clearly, manual control eliminates or inhibits effective utilisation of automatic control systems whilst electrical motors are relatively expensive items when compared to the portion of time when they are actually utilised. Furthermore, electrical motors require maintenance and may be susceptible to failure.

It is an object of the present invention to provide an air flow control arrangement for a vehicle ventilation system which is both effective and reliable whilst avoiding the above-mentioned problems.

In accordance with the present invention, there is provided a flow control arrangement for a vehicle ventilation system, the arrangement comprising a plurality of associated vent members with a vent pathway therebetween, each vent member including an electrically conductive core and an electrical insulating flap

in which an alternative a positive and negative electrostatic charge can be induced, the insulating flap extending across the vent pathway between associated vent members, whereby that vent pathway may be opened by repulsion of similar polarity electrostatic charges and closed by attraction of opposite polarity electrostatic charges.

Preferably, the flap is cantilevered from a core section of the vent member.

The flaps may extend from one side of the vent member or be formed as wings extending from both sides with actuator members therebetween and engaged by these respective vent members. With a one side vent member, attraction/repulsion will be through opposite or similar electrostatic charges in adjacent vent members to close or open the vent pathway therebetween. With a vent member with flaps upon both sides, the flaps may retain consistently the same electrostatic charge with repulsion/attraction being achieved by changing the polarity of the electrostatic charge of the actuator member therebetween.

The electrically conductive core may be formed from a copper strip or wire.

The electrostatic charge in the flap may be induced by alternatively placing an electrical potential upon the electrically conductive core. Typically, the electrical potential placed upon the electrically conductive core will be in the order of 8 kV.

The vent members may be shaped to facilitate lift off upon opening and sealing upon closure between adjacent vent members and, where applicable, the actuator member between such vent members. This shaping may comprise chamfers upon the abutting portions of the vent member in order to precipitate substantially parallel surfaces therebetween upon closure of the pathway by a flap.

The flap may be incorporated in the vent member through a neck portion significantly thinner than the flap itself or other insulating material about the electrically conductive core such that the neck portion facilitates hinging of the flap thereabout.

The vent member may incorporate a bias member in order to bias the flap to a closed or open configuration across the vent pathway between adjacent vent members and where applicable an actuator member located therebetween.

Embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings, in which:

Figure 1 is a schematic cross-section of an air flow control arrangement in a closed configuration;

Figure 2 is a schematic illustration of the control arrangement depicted in Figure 1 in an open configuration; and

Figure 3 is a schematic illustration of an alternative embodiment of an air flow control arrangement.

It is known to provide flaps which may be opened and closed in order to provide a necessary vent pathway for air flows. However, as indicated previously, these vent arrangements typically required a specific actuation mechanism, either manual or through an electrical motor, in order to displace the flap between its opened and closed configuration. These arrangements may be inconvenient with regard to automatic climate control systems and susceptible to potential malfunction and, in any event, may require some maintenance.

In accordance with the present invention, and as illustrated in Figures 1 and 2, a plurality of vent members 1 are provided adjacent one another such that there is a vent pathway 2 therebetween.

Each vent member 1 includes an electrically conductive core 3 about which an insulating sheath is provided comprising a flap 4 and a core section 5 with a neck portion 6 therebetween. The flap 4 essentially closing the vent pathway 2 dependent upon an electrical charge attraction between adjacent vent members 1, i.e. respectively their flap 4 and normally a corner edge of the core section 5.

As can be seen, the electrically conductive core 3 can be provided with either a positive polarity or a negative polarity electrical DC potential. In such circumstances, it will be appreciated that the electrically insulating sheath comprising the flap 4, neck portion 6 and core section 5 thereabout will be induced with an opposite electrostatic charge. Thus, as illustrated in Figure 1 with regard to a closed configuration of a control arrangement in accordance with the present invention, if alternately adjacent electrically conductive cores 3 have opposite polarity electrical potential, the induced electrostatic charges in the flap 4 will precipitate attraction between that flap 4 and a core section 5 of the vent member 1 such that the pathway 2 is closed to air flow. However, as illustrated in Figure 2, if adjacent electrically conductive cores 3 have the same electrical potential, then the induced electrostatic charge in the flap 4 and core section 5 of the vent member 1 will be of similar polarity and thus repulse one another allowing air flow through an open vent pathway 2. In such circumstances, it will be appreciated that a relatively simple actuation mechanism for the air flow control arrangement in accordance with the present invention is provided.

The degree of opening precipitated by repulsion by similar polarity electrostatic charges in the adjacent core section 5 and flap 4 can be varied by

altering the value of such electrostatic charges as required. Furthermore, it will be appreciated that there is a degree of material bias resisting deformation along with potential gravitation effects upon the flap 4 closing, or opening, the pathway 2. These inherent biasing effects upon the flap 4 may be augmented by including specific bias members in or about the vent member 1 such that the repulsive/attractive combination of electrostatic charges acts in concert with such specific bias members to precipitate the most effective operation of the air flow control arrangement in accordance with the present invention. These bias members may comprise simple sprung strips of material, plastic or metal, incorporated in or about the vent member upon manufacture. Thus, it will be appreciated that by including such specific bias members, the ongoing electrical power required to maintain the flap in a closed or open configuration may be reduced.

It has been found that an electrical potential in the order of 8 kV is adequate to provide an induced electrostatic charge in the surrounding insulating material from which the flap 4 and core section 5 are manufactured. However, it will be appreciated that the actual size of the flap 4 and core section 5 will fundamentally determine the necessary electrical potential to precipitate adequate electrostatic charge in the flap 4 in particular. The flap 4, it will be noted, generally extends from one side of the vent member 1 in the embodiment depicted in Figures 1 and 2 and so, in such circumstances, a relatively strong electrical potential is required in the electrically conductive core 3 due to the remoteness of the abutting parts of the flap 4 and field polarity effects diminishing exponentially from the core 3.

Clearly, it is necessary that there is a limited loss effect as a result of electrical resistance within the electrically conductive core 3. Thus, the core 3 will be formed from a highly conductive material such as copper. Furthermore, the core 3 may take the form of a single solid cylinder or strip or comprise a plurality

of parallel or twisted strands arranged to precipitate the best induced electrostatic charge within the flap 4 and core section 5.

As illustrated in Figures 1 and 2, typically alternate pairs of vent members 1 can be secured to a common electrical potential rail 7, 8 in order to provide the necessary alternate electrical potential in the cores 3. However, although more complicated to wire, it will be appreciated that individual vent members 1, or alternate combinations or grouping of vent members 1, may be provided such that individual vent paths 2 may be opened, or different areas or sections of a vent panel opened separately or disproportionately in order to achieve best distribution of air flow through that vent panel constituted by the plurality of vent members 1 in accordance with the present invention. Thus, for example, within a motor vehicle, a vent panel constituted by vent members 1 may be located above ducting from a chiller unit and a heater unit such that, when desired, those vent members 1 above the ducting from the chiller unit may be disproportionally opened relative to those above the heater ducting, or vice versa, or in relative proportioning in order to mix the heated and chilled air flows to that required for climate control performance.

Typically, as illustrated, the flap 4 will essentially be a cantilevered extension from the core section 5. In such circumstances, it will be appreciated that the neck portion 6 may be of a narrower dimension, or otherwise weakened, in order to facilitate hinging about that neck portion 6 dependent upon the relative strength of attraction/repulsion precipitated by the electrostatic charges in an engaging combination of the flap 4 and core section 5 in the adjacent vent member 1. Clearly, when closed (Figure 1) an adequately robust seal must be provided to prevent air flow through the vent pathway 2 or, at least, substantially curtail such flow. A weakened neck section 6 reduces the material deformation resistance or bias of the insulating material from which the flap/core section 5 is made and so

precipitates potentially more aggressive, better sealing, attraction between the flap 4 and the core section 5. In the open condition (Figure 2), a weakened neck portion 6 allows more ready opening without the repulsive effect between similar polarity electrostatic charge in the flap 4 and the core section 5 being diminished by the necessity to overcome material deformation resistance/bias of the insulating material from which the neck portion 6 is made. As indicated previously, the deformation resistance or bias of the material from which the flap 4 and core section 5 is made, particularly at the junction defined as the neck portion 6, can be utilised in order to achieve a vent open or closed bias.

In order to achieve good sealing in the closed configuration of Figure 1, it will be appreciated that reciprocal shaping between the abutting portions of the flap 4 and the core section 5 is provided. Thus, where appropriate, re-entrant elements within these abutting surfaces may be provided or, more normally, the edges of the flap 4 and core portion 5 will be chamfered such that substantially in the closed configuration, the abutting surfaces are relatively parallel to one another. Such a parallel relationship may enhance the attractive or repulsive effect of electrostatic charges upon initial opening or final sealing for closure of the vent path 2 by the flap 4.

The insulating material from which the flap 4 and core section 5 is made will typically be of a plastics type such as nylon or polyester. Furthermore, the flap 4 and core section 5 may be moulded upon the core 3 or assembled by locating the core 3 in a pocket therefore made in a separately moulded or fabricated component. The insulating material may be solid or rigidified fabric or spun-bonded to the core 3 etc.

It is expected that the air flow control arrangement in accordance with the present invention will be combined in use with an electrostatic particle filter

and/or a constant outlet pressure blower fan. Thus, there will be a limit upon dust/dirt build up and prevention of a positive pressure from compromising the sealing of the flaps 4. It will be understood that there are limits to the strength to which the presented attraction between the flap 4 electrostatic charge and the core section 5 in terms of the electrostatic attraction strength. In such circumstances, it will be appreciated that a performance balance can be achieved by incorporating specific bias members which bias the flaps 4 into a closed configuration for adequate sealing by supplementing the electrostatic bond strength whilst a combination of the electrostatic repulsive effect described above in addition to the air flow pressure beneath can be used to achieve desired lift-off in order to open the vent pathway 2.

Typically, all the respective cores 3 will be maintained at their desired electrical potential in order to precipitate the necessary electrostatic charges of required polarity for open or closed configuration of each vent member 1. However, it will also be appreciated that, due to the inherent hysteresis lag of such electrostatic charges, it may be possible to sequentially refresh, over acceptable time periods, the electrostatic charge by periodic application of electrical potential/charge to the core 3, rather than constant application, and so diminish the necessary power drain upon the vehicle's resources.

Figure 3 illustrates an alternative embodiment of an air flow control arrangement in accordance with the present invention. In this alternative embodiment, respective vent members 31 have two wing flaps 34, 35 with a centrally located electrically conductive core 33. In between respective adjacent vent members 31, there is located an actuator member 32 which also includes an electrically conductive core 36. Thus, by appropriate provision of electrical potential upon the cores 33, 36, it will be appreciated that reciprocal electrostatic charge can be provided in the wings 34, 35 and in the insulating material cover 37

of the actuator member 32. In such circumstances, it will be appreciated that operation of the alternative arrangement depicted in Figure 3 is similar to that described with regard to Figures 1 and 2, in that similar polarity electrostatic charge in the flaps 34, 35 and the cover 37 produces a repulsive force opening vent pathways 38, 39 to air flow whilst opposite polarity electrostatic charges in the wings 34, 35 and the cover 37 produces an attractive force therebetween to close the vent pathways 38, 39 as depicted in Figure 3. Thus, it will be appreciated that the actuator member 32 alone may be varied in terms of its electrical potential provided in the core 36 in order to actuate opening of the respective vent pathways 38, 39 whilst the electrostatic charge induced upon the flaps 34, 35 may be retained permanently or refreshed periodically as required.

CLAIMS

1. An air flow control arrangement for a vehicle ventilation system, the arrangement comprising a plurality of associated vent members with a vent pathway therebetween, each vent member including an electrically conductive core and an electrically insulating flap in which alternatively positive and negative electrostatic charges can be induced, the insulating flap extending across the vent pathway therebetween vent members whereby that vent pathway may be opened by repulsion of similar polarity electrostatic charges and closed by attraction of opposite polarity electrostatic charges.

2. An arrangement as claimed in Claim 1, wherein the flap is cantilevered to a core section of the vent member.

3. An arrangement as claimed in Claim 1 or Claim 2, wherein each vent member includes respective flaps either side thereof and arranged to engage an actuation member therebetween associated vent members in the air flow control arrangement.

4. An arrangement as claimed in any of Claims 1, 2 or 3, wherein each electrically conductive core is formed from a single copper strip or wire extending through the length of the vent member.

5. An arrangement as claimed in any preceding claim, wherein the electrostatic charge induced upon respective flaps is induced by placing alternatively an electrical potential upon the electrically conductive core of respective flap members.

6. An arrangement as claimed in Claim 5, wherein the electrical potential is in the order of 8 kV.

7. An arrangement as claimed in any preceding claim, wherein respective portions of the vent member which abut upon closing of the vent pathway are reciprocally shaped in order to facilitate sealing therebetween upon such closure by attraction between opposite electrostatic charges and/or to facilitate lift off between these respective portions of vent members upon opening of the vent pathway due to repulsion between similar electrostatic charges.

8. An arrangement as claimed in Claim 7, wherein the shaping comprises chamfers to each respective flap and/or the core section of the vent member.

9. An arrangement as claimed in any preceding claim, wherein there is a neck portion of the vent member from which the flap extends and such neck portion facilitates hinging of the flap about the vent member.

10. An arrangement as claimed in any preceding claim, wherein the vent member includes bias means in order to bias the flap into an open or a closed configuration across the vent pathway.

11. An air flow control arrangement substantially as hereinbefore described with reference to Figures 1 and 2.

12. An air flow control arrangement substantially as hereinbefore described with reference to Figure 3.

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Application No: GB 9903383.9
Claims searched: All

Examiner: Paul Gavin
Date of search: 15 April 1999

Patents Act 1977
Amended Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): F2V(VS20), F4V(VGBF,VGBJ)

Int Cl (Ed.6): B60H(1/00), F16K(31/02), F24F(13/15)

Other: Online : WPI, EPODOC, PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	EP 0 828 101 A1	(XEROX)	
A	EP 0 025 280 A1	(I.C.I.)	
A	US 5 054 522	(BURKERT)	
A	US 4 585 209	(AINE & BLOCK)	

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&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.